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D E C I S I O N
of 7 December 1994

Case Number: T 0215/92 - 3.2.5

Application Number: 83105922.5

Publication Number: 0097335

IPC: D02G 3/02, D01G 1/08, D02G 3/04

Language of the proceedings: EN

Title of invention:
High strength aramid spun yarn

Patentee:
E.I. DU PONT DE NEMOURS AND COMPANY

Opponent:
I HOECHST AKTIENGESELLSCHAFT
II Akzo N.V.

Headword:
-

Relevant legal provisions:
EPC Art. 54, 56

Keyword:
"Inventive step (yes)"

Decisions cited:
-

Catchword:



Case Number: T 0215/92 - 3.2.5

D E C I S I O N
of the Technical Board of Appeal 3.2.5
of 7 December 1994

Appellant: HOECHST AKTIENGESELLSCHAFT
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Decision under appeal: Decision of the Opposition Division of the
European Patent Office delivered on
11 December 1991 and posted on 17 January 1992,
rejecting the opposition filed against European
patent No. 0 097 335 pursuant to Article 102(2)
EPC.

Composition of the Board:

Chairman: C. V. Payraudeau
Members: W. D. Weiß
H. P. Ostertag

Summary of Facts and Submissions

- I. Two oppositions based on Article 100(a) EPC (lack of novelty and inventive step) were filed against the European patent No. 0 097 335.

The Opposition Division in its following decision held that the grounds for opposition mentioned in Article 100(a) EPC did not prejudice the maintenance of the patent unamended and rejected the oppositions.

- II. The Opponent I lodged an appeal against this decision and requested that it be set aside and the patent be revoked.

The Respondent (Patentee) requested that the appeal be dismissed and, hence, the patent be maintained as granted.

The Party as of Right (Opponent II) did not file any request.

- III. The patent as granted contains the independent Claims 1, 5, 9 and 10 which read as follows:

"1. A sliver of stretch broken, high strength, high modulus p-aramid fibers of which at least 50% of the fiber ends are fibrillated into at least 5 fibrils along a terminal length which is at least 50 times as long as the diameter of the unfibrillated portion of each fiber.

5. Process for preparing the sliver of claim 1 by feeding a yarn or tow of continuous p-aramid filaments having a filament tenacity of at least 18 gpd and a filament modulus of at least 400 gpd under low tension into a tensioning zone, tensioning the filaments almost to their breaking tension, randomly breaking the

tensioned filaments by sharply deflecting them laterally with interdigitating mechanical deflectors, removing the resulting sliver from the tensioning zone and optionally crimping the filaments.

9. Spun yarn obtained by processing the sliver of claims 1-4 in the worsted system.

10. Spun yarn obtained by processing the sliver of claims 1-4 in the cotton system."

IV. In his Grounds of Appeal, the Appellant put high emphasis on document

D5: Brochure "Les Fils Industriels", s.a. Schappe,
8 pages,

which had been disregarded by the Opposition Division, because there was neither evidence that this document had been published before the priority date of the patent in suit nor that the slivers mentioned therein had been publicly used.

In a communication accompanying the summons for oral proceedings the Board communicated its intention also to disregard document D5.

V. During the oral proceedings, held before the Board on 7 December 1994 and at which the Party as of Right did not appear, the Appellant based his arguments with respect to lack of novelty and of inventive step on the following documents:

D2: US-A-2 419 320,

D4: US-A-4 080 778,

D8: Journal of Applied Polymer Science, Vol. 21 (1977),
pages 2791 to 2815.

The Respondent additionally relied on document D9: Textile Industries, April 1980, pages 99 to 101, which he had introduced in the course of the opposition proceedings.

VI. The Appellant argued essentially as follows:

There were two chains of arguments leading to the conclusion that the subject-matter of the product claim 1 was not novel or at least did not involve an inventive step.

The "simple tensile tests" described in document D8 (pages 2795 to 2801) and carried out on an "Instron" tester resulted in a fracture morphology characterised by an extensive splitting of one end of the broken fibre. In other words, the stretch broken fibre contained about five fibrils (see Fig. 4) having lengths of between 40 to 70 filament diameters. Thus the "Instron" tester subjected the single fibre to a stress which was very similar to the stress to which a tow of filaments was subjected during the application of the Halle-Seydel process as admitted by the Respondent himself. It must be concluded from this analogy that the unconsolidated yarn (28) produced according to Example XII of document D4 was an intermediary product meeting the features of a sliver according to Claim 1 or at least being close to do so.

Moreover, the sliver claimed in Claim 1 was the inevitable result of the process according to Claim 5 which was obvious to a person skilled in the art.

There were three well known processes for stretch breaking a tow of synthetic filaments for spinning: the Halle-Seydel process, the Converter process and the Turbo stapler process. At the priority date of the patent in suit, the Turbo stapler process was much more in use in the USA than the two other processes (see document D9, p. 99, Fig. 1). For this reason, a skilled person wanting to produce a sliver of fibres from a tow of aramid filaments would have been incited to use to this end the Turbo stapler process. There were also no prejudice against the use of a such process which breaks the aramid filaments by fatigue since, according to the document D8 (p. 2814), the fibres obtained by fatigue breaking present longer axial splits.

VII. The Respondent presented essentially the following arguments:

The Appellant had submitted that the fibres produced according to the "simple tensile tests" of document D8 were similar to the fibre constituting the sliver according to Claim 1 of the patent in suit because they showed the presence of fibrils at one end of the fibre. However, the results of the tests showed that only one end of the fibre was fibrillated. Therefore, the fibres obtained with the "Instron" tester were still different from the fibres constituting the sliver according to the patent in suit. Moreover, a test made on a single filament cannot represent the conditions which exist when a bundle of filaments are submitted to a similar but not identical treatment.

On the other hand, the process as shown in document D4 used a process similar to a Halle-Seydel process to make a yarn of entangled fibres. This yarn or an intermediate ribbon could not be considered as constituting a sliver as defined in the patent in suit. Its strength was only

about one third of the strength of the initial filaments, which relation was independent of the specification of the particular test used. This result alone demonstrated that the yarn obtained was not manufactured from a sliver having the claimed features.

Contrary to the allegation of the Appellant, the person skilled in the art wanting to prepare a sliver of fibres from aramid filaments would not have tried to use to this end a Turbo stapler. In fact, the teaching of the document D8 as well as of the document D9 would have led him to use a Halle-Seydel machine (tensile breaking) since "the fibre comes out much cleaner" (D9, col. 2; see also Fig. 6 and 7 of the patent in suit) and since "the existence of many fibrils and fibrillar strands separated from the outer layer of the filaments (which is produced when using the Turbo stapler machine) indicated a weak cohesion between fibrils. It was clearly necessary to take care in processing Kelvar in order to minimise the development of this type of damage." (D8, p. 2794, lines 4-6).

Reasons for the Decision

1. *Content of the state of the art*

The document D5 has been cited by the Opponent II (Party as of Right to the present appeal) during the opposition procedure with respect to an alleged prior use. This "brochure" which does not bear any information as regards its date of publication indicates that spun yarns from long aramid fibres having a strength of 12/14/cN/dtex which corresponds to 60-70% of the strength of the yarn made with continuous filaments have been for sale since 12 years.

The Appellant has submitted that this indication was a sufficient proof that a spun yarn having the same properties as the yarn obtained from the sliver according to the patent in suit had already been publicly offered for sale and that therefore the yarn claimed in the patent in suit was no more new and its method of fabrication was not inventive.

The Opposition Division has, in the decision under appeal, disregarded this document on the ground that no evidence had been submitted that the brochure had been published before the priority date of the present patent nor any details had been given for substantiating the alleged prior use.

The Board of Appeal can only confirm the decision under appeal on this point for the same reasons. The document D5 is therefore considered as not to be part of the state of the art.

2. *Novelty*

- 2.1 None of the documents cited discloses a "sliver of stretch broken aramid fibres" as claimed in Claim 1 of the patent in suit.

The document D8 shows a single isolated fibre broken with an "Instron" tester and the document D4 shows the production of an entangled yarn from a ribbon of parallel synthetic continuous filaments which are stretch broken between two sets of rollers 9, 10 and 11, 12 and pass into an aspirator 17 and then through an entangling jet 18 to form a yarn of entangled discontinuous fibres. Therefore, the process disclosed in the document D4 does not, even for a short period, produce an intermediate product which could be called a sliver, i.e. an assemblage of generally parallel fibres

which is apt to be drawn and twisted into a yarn by a conventional spinning process. Also the distribution of fibre lengths resulting from the stretch breaking step would disqualify this intermediate product for a conventional spinning process.

Moreover, the single fibre end displayed in Fig. 4(b) of document D8 does not even meet the requirements set for 50% of the fibre ends of the sliver according to Claim 1, since this known end is first split into four fibrils, a fifth fibril separating only remote from the fibrillated end. Consequently, the fibre end displayed in Fig. 4(b) is not "fibrillated into at least 5 fibrils along a terminal length which is at least 50 times as long as the diameter of the unfibrillated portion of each fibre".

Consequently, the simple tensile tests described in document D8 do not prove, and not even justify the suspicion, that the ribbon (5a) when executing Example XII of document D4, after the delivery rolls (11, 12) of the drafting zone (31), has a morphology as defined in Claim 1 of the patent in suit.

- 2.2 None of the other documents concerns the production of sliver of aramid fibres. The subject-matter of Claim 1 is, therefore, novel.
- 2.3 The same applies to the subject-matter of Claims 9 and 10 since these claims concern yarns made from this new sliver.
- 2.4 Both parties agree that the process according to Claim 5 consists essentially in using a Turbo stapler machine for breaking a bundle of continuous aramid filaments into a sliver of fibres. None of the cited documents

discloses such a process which is consequently also novel. The novelty of the subject-matter of Claim 5 has also not been contested by the Appellant.

3. *Closest state of the art*

3.1 Amongst the documents cited during the opposition and appeal proceedings, only document D4 (Example XII) relates to the production of some kind of spun yarn from p-aramid filaments. This known process, however, does not follow the conventional process route which comprises the production of a twisted yarn from a stretch-broken sliver (see point 2.1 above).

3.2 Example 5 (Comparative) of the patent in suit acknowledges, however, that spun yarns made from equivalent p-aramid continuous-filament yarns via sliver obtained using a modified Seydel stretch breaker was commercially available at the priority date of the patent, and, therefore, belonged to the state of the art.

3.3 The Board, considers this yarn, the process and the sliver forming an intermediate product when executing this process to constitute the prior art which lies closest to the claimed subject-matter.

4. *Technical problem and solution*

4.1 According to Example 5 (Comparative) of the patent in suit, the tenacity of a commercial spun yarn made from p-aramid continuous-filament yarns via sliver obtained using a modified Seydel stretch breaker is only one fourth to one third of the filament tenacity which is at least 18 gpd (15.9 dN/tex).

Starting from the closest prior art as defined in point 3.3 above, the technical problem consists in providing a yarn of p-aramid filaments the tenacity of which is not reduced to such a high degree when compared to the tenacity of the original filaments.

- 4.2 In the process aspect of the patent in suit, this problem is solved in that a Turbo stapler process is used in the stretch-breaking step instead of a modified Halle-Seydel process.

The Turbo stapler process results in a sliver comprising the features of Claim 1.

The sliver, when spun conventionally, results in a yarn according to Claims 9 or 10, which yarns have tenacities of about 50 to 70% of the original continuous filaments.

5. *Inventive step*

- 5.1 It is not contested that the three processes, i.e. the Converter, the Turbo stapler and the Halle-Seydel process, were commonly used at the priority date of the patent in suit for breaking bundles of continuous synthetic filaments into slivers of fibres (D9, Fig. 1). The question to be answered is therefore not whether the person skilled in the art who knew these processes and their general advantages and drawbacks as summarised in the document D9 could, but whether he would have chosen the Turbo-stapler process to prepare a sliver of aramid fibres in view of obtaining spun yarns of higher tenacity with respect to the use of the Seydel process. As rightly submitted by the Respondent, the document D9 indicates that the general opinion of the persons skilled in the art was that the Seydel process allowed to produce yarns of far higher quality than the other two known processes because the defects obtained with an

assist breaker or with crushing were eliminated. The skilled person would consider, therefore, that the Seydel process was much more appropriate for solving the problem underlying the present invention and could in no way expect that - on the contrary - the Turbo-stapler process would result in a yarn of much higher tenacity than yarns obtained via the hitherto used Seydel process.

5.2 Consequently, the person skilled in the art would not have had any reason to experiment with the Turbo stapler process for producing a sliver of aramid fibres but he would have rejected the idea of using a process which was likely to produce yarns of inferior quality.

5.3 The Appellant also has put forward that a person skilled in the art would have preferred the Turbo-stapler process since, in view of the teaching of document D8, it was to be expected that this process would produce fibres with fibrillated ends.

However, the splitting into fibrils is considered by document D8 to be a damage which should be avoided by careful processing of the filaments (cf. page 2794, last paragraph).

5.4 Therefore, the subject-matter of the independent Claim 5 of the patent in suit involves an inventive step. The same applies also to the sliver of aramid fibres made with this process and which present the features claimed in Claim 1 as well as for the spun yarn obtained by processing the said sliver as claimed in independent Claims 9 and 10 of the patent in suit.

5.5 The grounds for opposition invoked by the Appellant do not therefore prejudice the maintenance of the patent unamended.

5.6 The Board observes that the description and claims of the patent in suit contain many irregularities notably in that contrary to Rule 35(12) EPC, units of weights and measures (such as denier, Cotton count, inches) which do not belong to the metric system have not also been expressed in terms of the metric system. However, since the presence of such irregularities is not a ground for opposition, the patent can nevertheless be maintained without correction.

Order

For these reasons it is decided that:

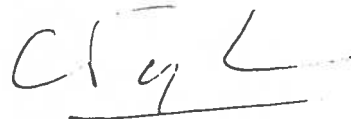
The appeal is dismissed.

The Registrar:



A. Townend

The Chairman:



C. Payraudeau